

## Recognition of Risk

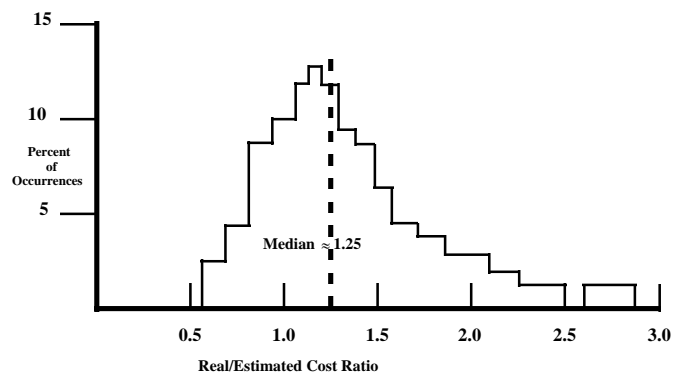
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- The Forecast is “always wrong”
- Evidence
- Rationale

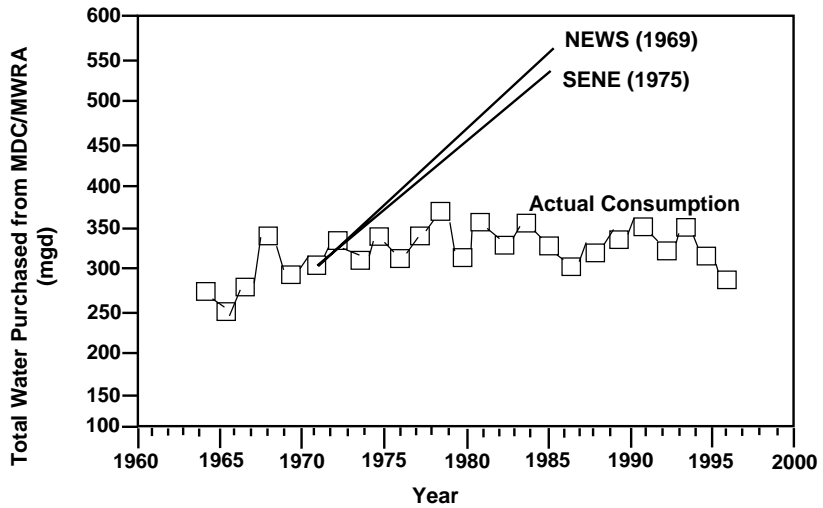
## Ratio of Real Costs

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Expressed in constant dollars, to estimated costs for routine airport projects



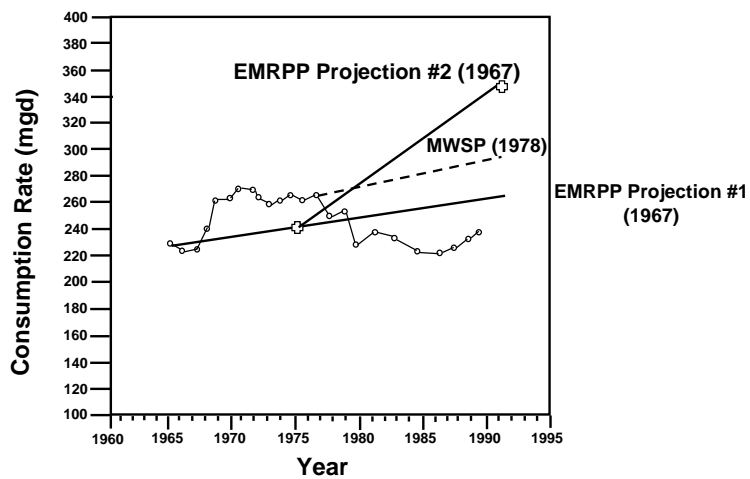
## Forecasts of Water Use in Boston (MWRA Members)



Engineering Systems Analysis for Design  
Massachusetts Institute of Technology

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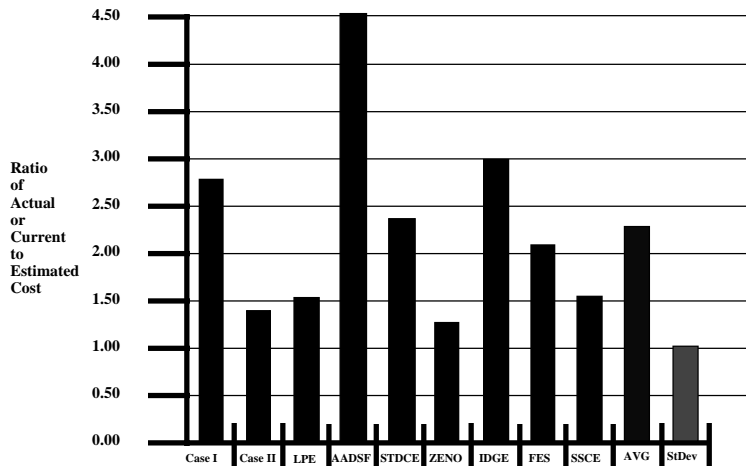
## Forecasts of Water Use in Boston (MWRA Service Area)



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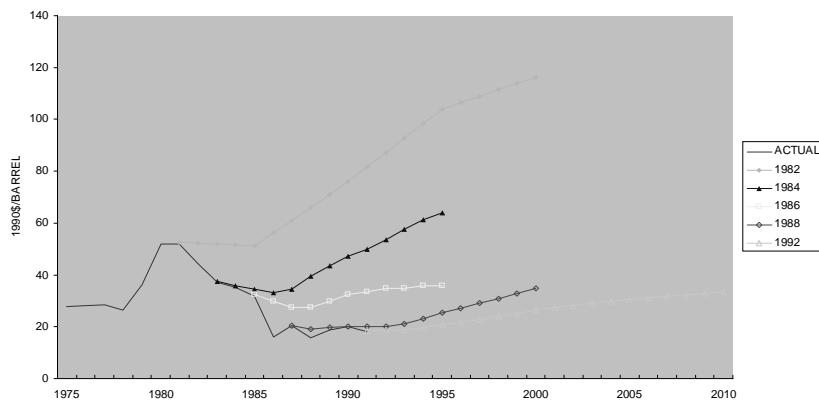
## NASA Microgravity Projects Cost Growth Experience



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## DOE Oil Price Forecasts

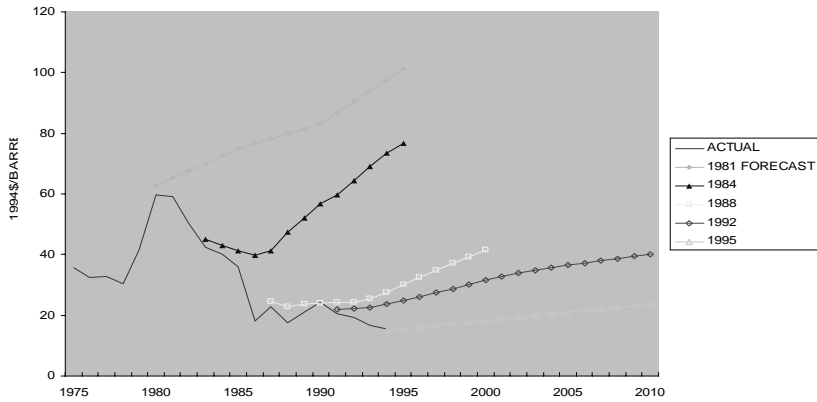


Source: M. Lynch, MIT

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## DOE Oil Price Forecasts

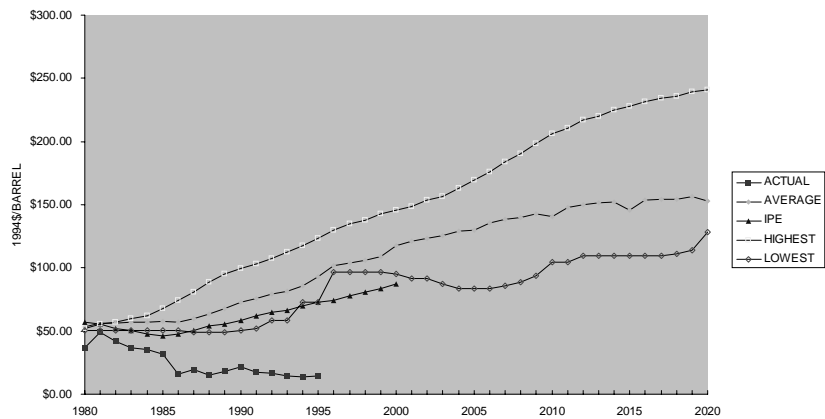


Source: M. Lynch, MIT

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## EMF6 Oil Price Forecasts

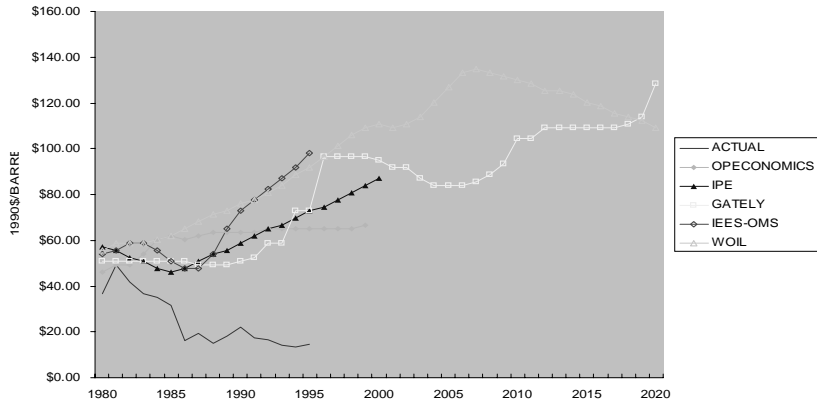


Source: M. Lynch, MIT

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## EMF6 Oil Price Forecasts (Low Forecasts)

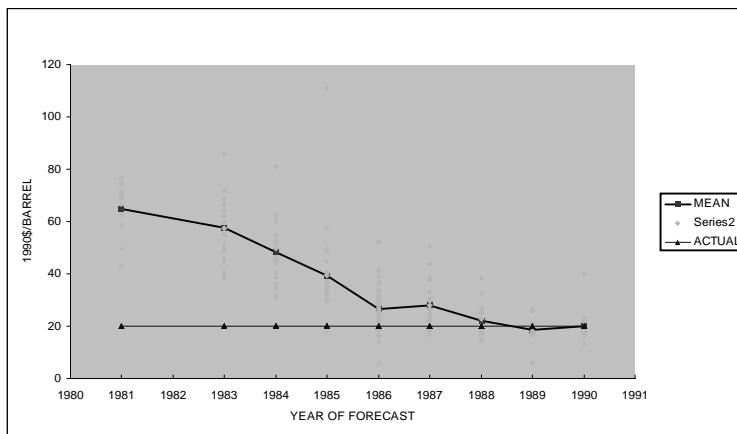


**Source: M. Lynch, MIT**

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## Forecasts of 1990 Price of Oil (IEW Survey)

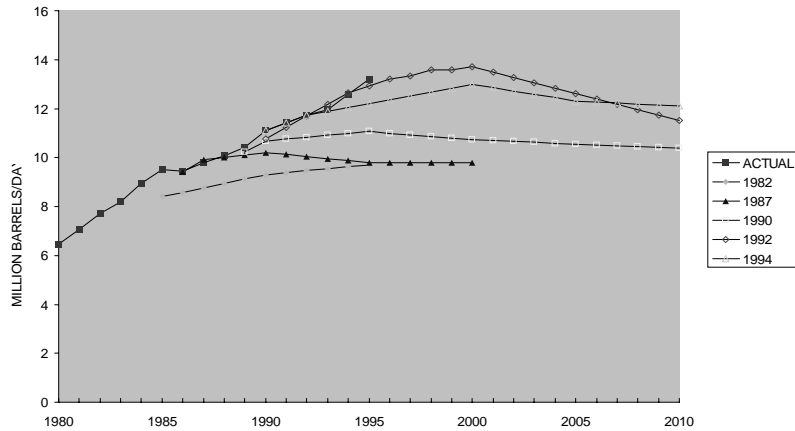


**Source: M. Lynch, MIT**

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## DOE Forecasts of Non-OPEC LDC Production

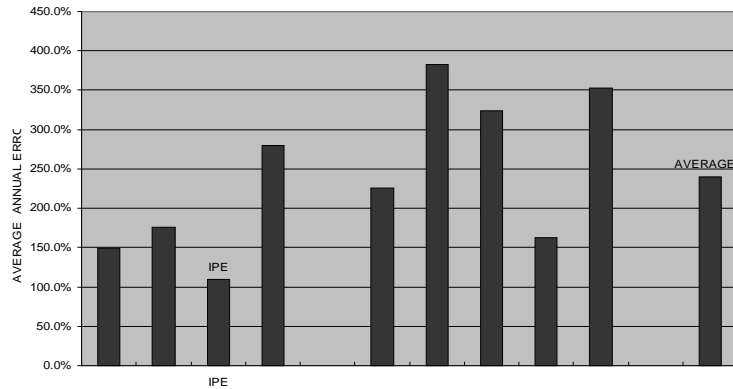


Source: M. Lynch, MIT

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## Error in OPEC Revenue Forecast at EMF6, 1980 - 1995



Source: M. Lynch, MIT

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## **Recognition Of Risk**

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- **The usual error**
  - Search for correct forecast
- **However: the forecast is "always wrong"**
  - What actually happens is quite far, in practically every case, from what is forecast
  - Examples: costs, demands, revenues and production
- **Need to start with a distribution of possible outcomes to any choice or decision**

## **Reason for Uncertainty -- Surprises**

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- **Reason 1 : Surprises**
  - All forecasts are extensions of past
  - Past trends always interrupted by surprises, by discontinuities:
    - ◆ Major political changes
    - ◆ Economic booms and recessions
    - ◆ New industrial alliances or cartels
- **The exact details of these surprises cannot be anticipated, but it is sure surprises will exist!**

## **Reasons for Uncertainty -- Ambiguity**

- **Reason 2 : Ambiguity**
  - Many extrapolations possible from any set of historical data
    - ◆ Different explanations (independent variables)
    - ◆ Different forms of explanations (equations)
    - ◆ Different number of periods examined
  - Many of these extrapolations will be "good" to the extent that they satisfy usual statistical tests
  - Yet these extrapolations will give quite different forecasts!

## **Rear View Mirror Analogy**

- **Relying on forecasts is like driving by looking in a rearview mirror --**
  
- **Satisfactory for a while, so long as trends continue, but soon one runs off the road.**



## **Consequence of Not Recognizing Risk**

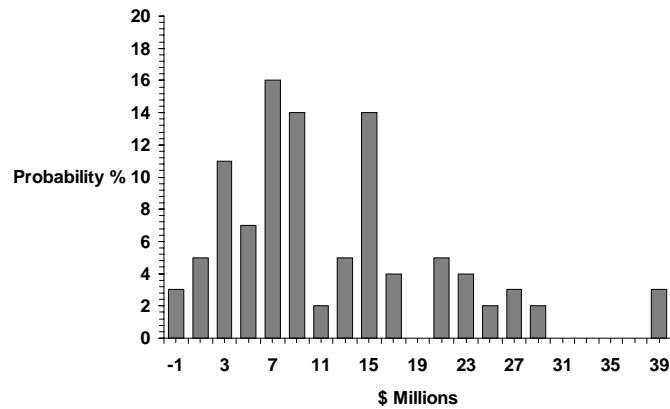
- **The Resulting Problem: Wrong Plans**
  - **Wrong Size of Plant, of Facility**
    - ◆ **Denver Airport**
    - ◆ **Boston Water Treatment Plant**
  - **Wrong Type of Facility**
    - ◆ **Although "forecast" may be "reached"...**
    - ◆ **Components that make up the forecast generally not as anticipated, thus requiring**
    - ◆ **Quite different facilities or operations than anticipated**

## **What do we do?**

- **Estimate possible ranges**
- **Example: Atlantic City Power**
  - **Used a cost model**
  - **range of costs of resources**
  - **range of demands**
  - **range of patterns**
  - **range of reliability, etc**
- **See Figure**

## Forecast By Detailed Simulation

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## Summary

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- The Forecast is “Always Wrong”
- Better Analysis will not Provide Perfect Forecasts
- We must deal with Risk and Uncertainty